



**UNITED
NATIONS**



**Framework Convention
on Climate Change**

Distr.
RESTRICTED

FCCC/IDR.1/GBR*
24 February 1997

ENGLISH ONLY

**UNITED KINGDOM OF GREAT BRITAIN
AND NORTHERN IRELAND**

Report on the in-depth review of the national communication of the United Kingdom

Review team:

Paulo Motoki, Brazil

Ivan Mojik, Slovakia

Markus Maibach, Switzerland

Jan Corfee-Morlot, Organisation for Economic Co-operation and Development

Vitaly Matsarski, UNFCCC secretariat, report coordinator

Peer Stiansen, UNFCCC secretariat, visit coordinator

Also available on the World Wide Web (<http://www.unfccc.de>)

* Re-issued for technical reasons

BNJ.97-

Under Articles 4 and 12 of the Convention, Parties are required to prepare national communications on their implementation of the Convention. Guidelines for the preparation of national communications and the process for their review were agreed upon by the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, by its decisions 9/2 and 10/1, and by the Conference of the Parties, at its first session, by its decisions 2/CP.1 and 3/CP.1 (see FCCC/CP/1995/7/Add.1). In accordance with these decisions, a compilation and synthesis of the first 33 national communications from Annex I Parties was prepared (FCCC/CP/1996/12 and Add.1 and 2).

When reviewing the implementation of the Convention by Parties, the subsidiary bodies and the Conference of the Parties will have this report available to them in English as well as the summary of the report in the six official languages of the United Nations. (These bodies will also have before them the executive summary of the first national communication of the United Kingdom and country-specific information drawn from a compilation and synthesis report covering all countries that have submitted national communications.)

Summary¹

1. The in-depth review of the national communication was carried out between September 1995 and December 1996 and included a visit to London by the team from 9 to 13 October 1995. The team included experts from Brazil, Slovakia, Switzerland and the Organisation for Economic Co-operation and Development (OECD). The United Kingdom was one of the first Parties to submit a national communication to the secretariat; it also submitted additional documentation supplementing and updating the national communication, in particular the 1995 *Progress Report on Carbon Dioxide Emissions*.

2. The United Kingdom is practically self-sufficient in energy, with considerable reserves of oil, natural gas and coal. It also has a sizeable nuclear industry, which presently accounts for about 18 per cent of the electricity generation capacity. In 1990 it had a lower-than-average level of energy use per capita compared with other OECD countries (3.7 tonnes of oil equivalent (toe) in comparison to 4.8 for OECD countries) but a slightly higher level than the average for the European Community (3.6 toe). Radical restructuring of the British economy, including privatization and liberalization of the energy sector, has been taking place since the early 1980s. Removal of subsidies in the coal industry, as well as developments in the electricity sector and in the gas market, led to a shift to natural gas for electricity generation. The mix of fuels used for electricity generation changed significantly in the United Kingdom in the period from 1990 to 1994. The share of coal declined from around 65 per cent to about 50 per cent, and that of oil from 11 to 5 per cent; the share of nuclear power increased from 21 to 29 per cent and that of natural gas from less than 1 to 13 per cent. These developments brought about substantial greenhouse gas (GHG) emission reduction benefits. The projected overall reductions in carbon dioxide (CO₂) emissions up to the year 2000 will be chiefly due to use of lower-carbon fuels, including an increase in the use of natural gas and nuclear power at the expense of coal and oil. The majority of these reductions are expected from the power sector. The original target of the United Kingdom's GHG programme set in 1994 was to return CO₂ emissions in 2000 to their 1990 level by achieving a reduction of around 37,000 Gg CO₂ or 10 million tonnes (Mt) of carbon (C). Since March 1995 the United Kingdom expects to exceed this target by *reducing* its CO₂ emissions to 4 - 8 per cent (22,000 - 48,000 Gg or 6 - 13 Mt C) below 1990 levels by the year 2000.

3. In its climate change policy the United Kingdom is applying a "gas-by-gas" approach to the control of GHGs emissions and is committed to taking measures aimed at returning emissions of each of the main GHG to 1990 levels by 2000. Overall, CO₂ emissions declined in the period from 1970 to 1985. The second half of the 1980s witnessed a slight upward trend, however, with minor fluctuations. The 1990 inventory updated in October

¹ In accordance with decision 2/CP.1, of the Conference of the Parties the full draft of this report was communicated to the Government of the United Kingdom, which had no further comments.

1995 shows that emissions of carbon dioxide (excluding CO₂ uptakes from land-use change and forestry) in the United Kingdom totalled 577,012 Gg. In terms of 1994 global warming potentials (GWP) CO₂ accounted in 1990 for about 80 per cent of total GHG emissions. Relative inventory figures for anthropogenic emissions of CO₂ excluding land-use change and forestry for 1991-1994 in comparison to 1990 (100 per cent) are as follows: 1991 - 101 per cent, 1992 - 98 per cent, 1993 - 96 per cent, 1994 - 94 per cent, thus confirming the general downward trend in total CO₂ emissions. Total methane emissions in 1990 amounted to 4,531 Gg, with an estimated reduction of 14 per cent by 1994. Emissions of nitrous oxide (N₂O) totalled 108 Gg, carbon monoxide (CO) - 6.7 Gg, nitrous oxide (NO_x) - 2,740 Gg and non-methane volatile organic compounds (NMVOC) - 25,400 Gg. The United Kingdom largely relied on its own methods for estimation of GHG emissions and followed quite closely the Intergovernmental Panel on Climate Change (IPCC) reporting structure. The review team was of the opinion that as a whole the inventory information provided by the United Kingdom was of a high quality, transparent and consistent.

4. The team noted that at present the majority of measures implemented or planned in the United Kingdom's programme are either of the "no regrets" type or have other benefits such as raising general revenue, and reductions in GHG (especially CO₂) emissions achieved so far are mainly due to the fuel switching as a consequence of energy market liberalization. The programme, which is coordinated by the Cabinet, includes a number of policies and measures with specific emphasis on increased energy efficiency on the supply side and on energy-saving programmes on the demand side. Policies and measures implemented in accordance with the programme would allow on average additional savings of about 27,500 Gg of CO₂ emissions or about 7.5 Mt C by the year 2000. The strategy of increasing fuel duties by an average of at least 5 per cent above the inflation rate every year is an important measure to reduce CO₂ emissions. This allows motorists to respond in the most efficient and flexible way, by driving less, purchasing more fuel-efficient vehicles or adopting more economical driving styles. The team found the Energy Saving Trust to be an innovative and potentially significant mechanism for emissions reduction, subject to adequate funding of its activities. The team noted that the United Kingdom's strategy for combating climate change to a large extent depends on a partnership approach (including voluntary agreements with industry), and that monitoring climate-related activities is important taking into account that without additional measures early next century GHG emissions may start to rise.

5. Both "with measures" and "without measures" projections have been made. The results of modelling indicate that, based on the assumptions used, in each scenario projected CO₂ emissions in 2000 would not exceed their 1990 level even without additional measures listed in the climate change programme. In the period between 2000 and 2020 every scenario projects an increase in CO₂ emissions - rising significantly from 2000 to 2005, then almost levelling off and sharply rising again between 2010 and 2020. This trend reflects the fact that local reserves of natural gas may diminish, demand for energy is expected to increase and the majority of nuclear power stations will reach the end of their life soon after the year 2000. The projections indicate that emissions of gases other than CO₂ will continue

to decline (as was the case between 1990 and 1995). The United Kingdom is considering developing improved procedures for monitoring the effects of individual CO₂ abatement measures. They will depend on the type of measures and will, for example, include econometric models to assess effects of fiscal measures, feedback from industry for voluntary agreements, evaluation of results of introducing new standards, and national statistical data for combined heat and power (CHP) and renewable energy sources.

6. Changes in climate could have significant impacts in some sectors and in some regions of the United Kingdom, both of a beneficial and of an adverse nature. Research in this area will be continued with the aim of identifying possible adaptation measures in potentially vulnerable sectors and areas. The United Kingdom has not implemented specific adaptation measures so far but response strategies are investigated as part of the impact assessment apart from MAFF's measures to protect the UK coastline.

7. The United Kingdom contributed fully to the Global Environment Facility, both at the pilot phase and for the replenishment, and has specific strategies for environmental assistance, including climate change. The United Kingdom has committed a total of £130 million to the Facility, and is the fifth largest donor. Transfer of technology and know-how is a central element in most aid projects. The United Kingdom particularly acknowledges the role of the private sector in technology transfer and has set up a "technology partnership initiative" to facilitate such transfer.

8. The team felt that the United Kingdom has to be commended for the scope and quality of both national and international climate change research. In addition to research on inventories methodology, renewable energy sources, mitigation options and impact assessment, a comprehensive climate research programme is under way. The United Kingdom provided technical support units that facilitated preparation of the IPCC Report on Radiative Forcing and the IPCC Guidelines for National Greenhouse Gas Inventories. It finances the activities of the technical support unit of Working Group I of the IPCC, which is responsible for the science of climate change. According to estimates, the United Kingdom spent about £200 million on climate change research in 1993/94.

9. Some £130 million have been spent on energy and fuel efficiency awareness and advice programmes since 1990. Targeted groups include specific sectors of the economy, consumers, non-governmental organizations and households. The Environment and Energy Management Directorate's Best Practice Programme is the Government's main programme for dissemination of information on cost-effective energy efficiency measures. The Government recognizes the need for a body to coordinate and promote the teaching of energy efficiency in schools. It considers that the Centre for Research, Education and Training in Energy (CREATE) is best placed to carry out this role and has increased support for its activities. Many environmental groups provide information on the greenhouse effect and the environmental consequences of energy use to individuals. Industry non-governmental

organizations play an important role in concluding and implementing voluntary agreements which constitute an essential part of the United Kingdom's climate change policy.

I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

10. The United Kingdom of Great Britain and Northern Ireland ratified the Convention on 8 December 1993. Its national communication was received by the secretariat on 7 February 1994.

11. The in-depth review of the national communication was carried out between September 1995 and December 1996 and included a visit by a review team to London from 9 to 13 October 1995. The team consisted of Mr. Paulo Motoki (Brazil), Mr. Ivan Mojik (Slovakia), Mr. Markus Maibach (Switzerland), Ms. Jan Corfee-Morlot (Organisation for Economic Co-operation and Development) (OECD), Mr. Vitaly Matsarski (UNFCCC secretariat, report coordinator) and Mr. Peer Stiansen (UNFCCC secretariat, visit coordinator). In the course of the visit, the team met officials of the main government departments involved and representatives of agencies, the academic community and non-governmental organizations.

12. The United Kingdom's national climate change programme described in the national communication was adopted after extensive discussions among governmental bodies, local authorities, energy utilities, business and environmental non-governmental organizations. The United Kingdom was one of the first two Parties (together with Canada) to submit a national communication to the secretariat. The communication was therefore drafted without reference to the recommendations of the Intergovernmental Negotiating Committee (INC) on the format and structure of national communications or the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. To comply with these Guidelines, inventory data in the IPCC format and a summary of the national communication were additionally submitted to the secretariat by the due date for the national communication, that is by 21 September 1994. The United Kingdom also provided the secretariat and the review team before, during and after the visit with updated additional information on a number of key areas covered by the communication, including the *Progress Report on Carbon Dioxide Emissions* (covering mainly energy-related emissions) published in December 1995, thus substantially supplementing it. While submitting inventory data for 1994 (in 1996), as requested by the Conference of the Parties, the United Kingdom also updated its inventory data for 1990-1993. The team was also given background information for these documents.

13. The national communication and additional information together constitute a comprehensive updated overview of the United Kingdom's activities aimed at combating global climate change and cover all major sectors and all greenhouse gases (GHGs). The

United Kingdom is applying a “gas-by-gas” approach and is committed to taking measures aimed at returning emissions of each of the main greenhouse gases to 1990 levels by 2000. The United Kingdom also reported on a number of measures in the forestry sector aimed at preserving and enhancing sinks and reservoirs of carbon.

14. Overall, carbon dioxide (CO₂) emissions declined in the period from 1970 (when they amounted to about 664,000 Gg or 181 million tonnes (Mt) of carbon (C)) to 1985 (539,000 Gg or 147 Mt C), though two peaks occurred in 1973 and 1979. The second half of the 1980s witnessed a slight upward trend, with minor fluctuations. National inventory data for the period 1992-1994 confirm the downward trend in total CO₂ emissions. Methane (CH₄) and nitrous oxide (N₂O) emissions are also projected to be below 1990 levels by the year 2000, methane emissions are expected to be about 20 per cent lower, and nitrous oxide emissions about 70 per cent lower.

15. The United Kingdom is practically self-sufficient in energy, with considerable reserves of oil, natural gas and coal. It also has a sizeable nuclear industry, which presently accounts for about 18 per cent of the electricity generation capacity. In the early 1970s imports still accounted for more than 50 per cent of the country’s energy supply, but by the mid-1980s, as a result of North Sea oil and gas development, the country had become a net exporter of energy. In the early 1990s, the United Kingdom has been a small net exporter, essentially because of exports of oil. The breakdown of primary energy consumption in 1990 was as follows: petroleum 36.5 per cent, coal 31.5 per cent, natural gas 24 per cent and primary electricity 8 per cent. The index of real energy prices indicates a sharp decline in industrial prices from the mid 1980s to 1990, with domestic prices declining more slowly, owing to the drop in oil prices on the world market. The United Kingdom in 1990 had a lower-than-average level of energy use per capita compared with other OECD countries (3.66 tonnes of oil equivalent (toe) for the United Kingdom in comparison to 4.79 for the OECD countries) but a slightly higher level than the average for the European Community (EC) (3.63 toe).

16. Radical restructuring of the British economy, including privatization and liberalization of the energy sector, has been taking place since the early 1980s. Privatization of mines owned by British Coal was completed in 1994, the electricity sector was subject to radical restructuring affecting both supply and demand, and public ownership of the nuclear power industry was under review at the time of the visit. Though the rationale of the liberalization programme was mainly economic, it has had positive repercussions in reducing GHG emissions as a result of fuel switching in electricity generation. This process of economic restructuring is expected to continue until the end of the century.

17. Removal of subsidies in the coal industry resulted in a sharp decline in coal production and consumption between 1990 and 1994 (almost 50 per cent and 25 per cent respectively). Developments in the electricity sector and in the gas market led to a shift to natural gas for electricity generation. The mix of fuels used for electricity generation changed significantly in the United Kingdom in the period from 1990 to 1994. The share of

coal declined from around 65 per cent to about 50 per cent and that of oil from 11 to 5 per cent; the share of natural gas increased from less than 1 per cent to 13 per cent and that of nuclear power from 21 to 29 per cent. The nuclear power industry was the subject of the government's Nuclear Review which reported in May 1995. The main conclusions were that nuclear power should continue to contribute to the mix of fuels used by the electricity supply industry provided it maintains its current high standards of safety and environmental protection and is competitive; and that public sector support for a new nuclear power station would constitute a significant intervention in the market and is not warranted in current or foreseeable circumstances. The review announced UK Government's plan to privatize parts of the state-owned nuclear power companies in 1996.

18. As a member of the European Community (EC), the United Kingdom has to harmonize relevant national policies, including some policies and measures which help to mitigate climate change, with the overall EC policy. It participates in a number of the Community's energy-related programmes, such as SAVE (improving energy efficiency), ALTENER (promoting the use of renewable energy sources), and JOULE-THERMIE (improving conversion and use of energy).

19. The Department of the Environment, in particular its Global Atmosphere Division, takes the lead on climate change policy and coordinates the related activities of other agencies, in particular the Department of Trade and Industry, the Department of Transport and the Ministry of Agriculture, Fisheries and Food and the departments representing Northern Ireland, Scotland and Wales. These ministries have responsibility for most of the policies and measures affecting GHG emissions. Overall coordination of environment and energy policy is done by the Cabinet.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

20. The United Kingdom has a mature inventory system and a great deal of expertise in compiling greenhouse gas inventories. It has used this expertise to contribute to the international development of GHG inventory methodologies, in particular through contributions to the IPCC inventories programme implemented in collaboration with OECD and the International Energy Agency (IEA). Where a large degree of uncertainty is associated with estimates of certain sources or sinks, research is carried out to reduce the uncertainty. The review team was of the opinion that as a whole the inventory information provided by the United Kingdom in its national communication and in supplementary documentation was of a high quality, transparent and consistent. In most cases it provided enough information for a third party to reconstruct inventory data. IPCC reporting guidelines were followed and inventory information was provided in standard format.

21. The United Kingdom largely relies on its own methods for estimating GHG emissions. Wherever possible the United Kingdom uses its own emission factors to construct the estimates. As a member of the European Community, the United Kingdom uses both IPCC and CORINAIR² systems for development and reporting of inventories and generally finds no basic contradictions between the two systems since most of the inventory information for both purposes is derived from the detailed United Kingdom National Atmospheric Emission Inventory.

22. The United Kingdom has an emissions methodology for agricultural land-use change and abandonment of managed lands which is considerably more detailed than the IPCC approach. It is based on long-term trends in landuse together with an assessment of associated carbon dynamics. There is also a national methodology for a number of sources of emissions not currently covered in the IPCC guidelines: drainage of peat bogs, drainage of lowland wetlands, and peat extraction. Recent updates of the inventory show a doubling of the CO₂ emissions from drainage of peat bogs and no change in the lowland wetland and peat extraction activities. Current estimates are that forest removals amount to 8,700 Gg of CO₂ per year. Analysis of historic land-use change indicated that carbon flux from agricultural land was likely to be relatively small and consequently estimates for this category have not been revised from the original inventory submission. The United Kingdom is actively researching forest carbon fluxes with the aim of more precisely estimating emissions and removals from this sector, in which uncertainty at present is estimated to be ± 20 per cent.

23. The national communication includes an inventory of emissions by sources and removals by sinks for 1990 of CO₂, methane (CH₄), nitrous oxide (N₂O), the precursors carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs), and perfluorocarbons (PFCs). In terms of 1994 global warming potentials (GWP) CO₂ accounted in 1990 for about 79 per cent of total GHG emissions, methane for about 15 per cent, N₂O for around 5 per cent and other GHG for less than half a per cent. A number of documents on inventories or containing inventory updates have been prepared in the United Kingdom since the release of their first national communication and submitted to the UNFCCC secretariat. As a separate document, the minimum data tables for GHG emissions were provided in August and again in November 1994. Additionally, during the in-depth review, supplementary documentation was provided updating 1990 CO₂ and other direct GHG estimates. First-time inventories for 1991, 1992, 1993 and 1994 were also provided for direct greenhouse gases, along with relatively complete documentation of inventory estimation methods and key assumptions.

² CORINAIR is the component dealing with air emissions inventories of the European Community's CORINE (Coordinated Information System on the State of Natural Resources and the Environment).

24. The supplementary documents mentioned above contain a number of changes in the presentation of CO₂ emissions and sinks which bring these latest inventory data into conformity with the IPCC guidelines, namely:

(a) CO₂ removals from land-use change and forestry are reported separately from emissions of CO₂, but emissions of CO₂ from this sector are now added to the national total;

(b) A number of adjustments to deduct CO₂ emissions from organic waste streams have been made;

(c) CO₂ and other emissions from international bunker fuels (equivalent to 3.6 per cent of total CO₂ emissions in 1990) are now reported separately and, in accordance with the INC decision, were not included in total national emissions.

25. The updated 1990 inventory shows that emissions of **carbon dioxide** (excluding land-use change and forestry) in the United Kingdom totalled 577,012 Gg, 97.6 per cent of which were due to fuel combustion, 1.3 per cent to industrial processes, 1.0 per cent to fugitive fuel emissions and 0.1 per cent to waste. If emissions and removals from land-use change and forestry were added, the net CO₂ emissions would be 570,875 Gg, or one per cent less than the total figure given above. Fuel combustion contributed 563,401 Gg, of which 41.1 per cent was due to energy and transformation, 21.2 per cent to transport and 17.2 per cent to industry; other end-uses (residential, commercial and institutional) accounted for most of the remainder. As the electric power sector is the major consumer of fossil fuels, most of the CO₂ emissions (34 per cent in 1990) are produced by power stations. Relative inventory figures for anthropogenic emissions of CO₂ excluding land-use change and forestry for 1991-1994 in comparison to 1990 (100 per cent) are as follows: 1991 - 101 per cent, 1992 - 98 per cent, 1993 - 96 per cent, 1994 - 94 per cent.

26. **Methane** (CH₄) estimation methods generally correspond to tier 2 methods of the IPCC with few exceptions. Estimation of methane emissions is regarded as relatively uncertain and national methodologies are subject to frequent change reflecting the latest research results. The United Kingdom has used the so-called Monte Carlo method to combine expert judgements into an overall uncertainty estimate for methane emissions. This was found to be ± 20 per cent. Total CH₄ emissions in 1990 amounted to 4,531 Gg, of which 44.3 per cent came from landfills, 27.3 per cent from fugitive fuel emissions and 25.2 per cent from agriculture. Relative inventory figures for emissions of CH₄ for 1991-1994 in comparison to 1990 (100 per cent) are as follows: 1991 - 99 per cent, 1992 - 96 per cent, 1993 - 92 per cent, 1994 - 88 per cent.

27. Estimates for CH₄ emissions associated with offshore oil and gas production (as well as for CO₂, though these are less significant) have always been included in the United Kingdom inventory. These are spread between various categories: fuel combustion (i.e. energy and transformation), transportation (i.e. movement of products by ship), and fugitive

fuel emissions. During the team's visit, it was stated that the offshore industry's estimates of its own emissions in 1991 were about 20 per cent lower (UK Offshore Operators' Association Atmospheric Emissions Study 1993) than the estimates made for the Department of the Environment, and that the reasons for this were under investigation. The discrepancy has subsequently been traced to the emission factor assumed for gas flared or used directly by the industry, and the two estimates for emissions in 1991 now agree to about 5 per cent.

28. For **nitrous oxide** (N_2O), the United Kingdom has used emissions measurements to estimate the major source of N_2O , which is adipic acid production; other sources are mostly estimated on the basis of United Kingdom specific emission factors. The supplementary information on N_2O emissions describes a number of changes that have been made in the methods of estimation since the first national communication was published. These changes include a new emission factor for combined cycle gas turbines (CCGT), road transport emission factors taken from the IPCC guidelines and the inclusion of emissions from the combustion of biomass and from nitric acid manufacture. Estimates of N_2O emissions are described as uncertain but the uncertainty is not quantified. N_2O emissions in 1990 were estimated to be about 108 Gg, of which 73.9 per cent came from organic chemical (adipic acid) production and 12.0 per cent from inorganic chemicals (nitric acid). Relative inventory figures for emissions of N_2O for 1991-1994 in comparison to 1990 (100 per cent) are as follows: 1991 - 95 per cent, 1992 - 78 per cent, 1993 - 72 per cent, 1994 - 76 per cent.

29. Emission estimates of **precursors**, the indirect GHGs CO, NMVOCs and NO_x , are as reported under the UNECE/CORINAIR system and are based on a combination of plant-specific data and statistical data (particularly for small point sources, mobile sources and area sources). National emission factors are used for motor vehicles. It is estimated that the uncertainty in NO_x emissions is about ± 30 per cent. The total amount of NO_x emissions in 1990 was about 2,740 Gg (as NO_2). The bulk of CO (88 per cent) is emitted by motor vehicles. Uncertainties are currently estimated to be approximately ± 40 per cent. The total amount of CO emissions in 1990 was 6,683 Gg. The main sources of NMVOC emissions are transport and solvent use. The total amount of NMVOC emissions in 1990 was 25,400 Gg, but as some emission factors are very approximate, this figure is considered to be only ± 50 per cent accurate.

30. Supplementary documentation provided first estimates of emissions of hydrofluorocarbons **HFCs** and sulphur hexafluoride **SF₆** (about 1 Gg and about 0.14 Gg respectively). The team was informed that inventories for these substances and for **PFCs** were in the initial stages of development, and the estimates given were subject to considerable uncertainties.

III. POLICIES AND MEASURES

31. The United Kingdom has designed a range of policies and measures aimed at returning emissions of each of the main GHGs to 1990 levels by the year 2000. Policies

and measures enumerated in the national communication are thus directed at attaining these objectives. In the view of the team this balanced approach to GHG emissions is a strength of the United Kingdom's climate change mitigation policy.

32. The United Kingdom's climate change policy is based on a precautionary approach. The team noted that at present the majority of measures are of the "no regrets" type and reductions in GHG emissions achieved so far have mainly been due to fuel switching, privatization and deregulation. The full range of available policy tools, including economic instruments, regulatory measures, voluntary partnership actions and public information is, however, kept under consideration. The United Kingdom's strategy for combating climate change depends to a large extent on a partnership approach (including voluntary agreements with industry). Monitoring climate-related activities is important, bearing in mind that without additional measures GHG emissions may start to rise next century.

33. At the time of the visit, the Government was reviewing the progress achieved since publication of its initial communication, and mention was made in particular of some recent developments. One of them was a decision not to further raise value added tax (VAT) on domestic fuel and power from the current level of 8 per cent introduced in April 1994 to the general VAT level of 17.5 per cent that is applied for other commodities. Another such development was lower-than-expected carbon savings from the activities of the Energy Saving Trust (EST).

34. The main results of this review were published in the *Progress Report on Carbon Dioxide Emissions* (December 1995). They indicate that savings expected by 2000 owing to the introduction of VAT on domestic fuels and activities of the EST are now estimated to be significantly more modest than envisaged in the original communication, 2,600 Gg or 0.7 Mt C instead of 14,000 Gg or 4.0 Mt C).

35. The progress report shows that recent reductions in the United Kingdom's CO₂ emissions are mainly to be attributed to changes in energy use patterns linked to privatization and deregulation. This has resulted in radical changes in fuel supply, in particular the fossil fuel mix, for electricity generation consequent upon the fundamental transformations which took place in this industry during privatization. A parallel change in government policy (including the removal of subsidies for the coal industry) has led to a very significant increase in the use of natural gas, which, when used in combination with high-efficiency, combined cycle turbines, provides the most cost-effective and thus competitive way to produce electricity. The overall change in the United Kingdom's economic policy has brought about substantial GHG emission reduction benefits. The team also noted that specific mitigation measures enumerated in the climate change programme and its updates have contributed to the overall decrease in GHG emissions, though intermediate indicators of progress were not quantified in all cases.

36. The United Kingdom's policy of abating energy-related CO₂ emissions is based on two cornerstones: on the supply side it aims at increasing energy efficiency by deregulating markets and giving incentives to wider use of renewables, while on the demand side it encourages implementation of specific programmes and financial incentives to save energy (for example, to invest in energy-saving technologies). This policy relies on the use of synergies both on the supply and on the demand side, thus making it more difficult to estimate the effects of individual measures. Nevertheless, such an attempt has been made in the *Progress Report on Carbon Dioxide Emissions*. It shows that the net projected overall reductions in CO₂ emissions up to the year 2000 will mainly be due to use of lower-carbon fuels, including an increase in the use of natural gas and nuclear power at the expense of coal and oil. The majority of these reductions are expected to come from the power sector.

37. The increasing use of combined heat and power (CHP) contributes to energy efficiency and thus also to country's climate change mitigation policy. With an overall energy efficiency of up to 90 per cent, compared to 30-50 per cent for conventional electricity generation, it can save about 3,600 Gg of CO₂ or 1 Mt C per year for each 1,000 MW of CHP. The team was informed that the Government, as a part of its climate change programme, increased its existing CHP target from 4,000 to 5,000 MW of installed capacity by the year 2000. Though about 90 per cent of CHP capacity is installed in industry, this technology finds its way into other sectors, in particular the residential sector. Thus, CHP is now used on 66 sites covering 30,000 dwellings. In 1996, the Government announced certain deregulatory measures designed to assist CHP and other local forms of generation.

38. The regulators of the electricity and gas industries - Office of Electricity Regulation (OFFER) and Office of Gas Supply (OFGAS), established in 1990 and 1986 respectively as a result of privatization - require utility companies to provide advice on efficient use of energy. OFFER has reviewed the price controls for both supply and distribution by the public electricity suppliers; it has also allowed these companies to spend £1 per tariff customer per year from April 1994 for four years on energy efficiency projects, and modified the price control formula to reduce the incentive to sell more electricity. For electricity supply companies, new standards of performance have been set, prescribing the level of energy savings by customers, which should be delivered by schemes run by public electricity suppliers. Schemes approved in 1994-1995 are expected to result in a reduction of emissions of about 1,800 Gg of CO₂ or 0.5 Mt C over the lifetime of these measures.

39. On the demand side, the Government designated the Energy Saving Trust as a major element of the climate change programme and a mechanism for overcoming barriers to efficient use of energy. The Trust is an independent non-profit organization set up in 1992 and funded by the Government, the British public electricity suppliers and British Gas. Its aim is to promote the efficient use of all forms of energy by identifying, promoting and directing a number of energy efficiency schemes. It was originally envisaged that the activities of the Trust would result in savings of 9,200 Gg of CO₂ or 2.5 Mt C by the year 2000. The "E-factor", introduced by OFGAS in the tariff formula for controlling the gas

prices, allows expenditure by British Gas on approved energy efficiency schemes to be recovered in the tariffs charged to gas consumers. This has provided limited funds for two pilot schemes run by the EST: a one-year scheme offering a £200 rebate on gas condensing boilers and a two-year residential CHP scheme. However, in 1994 OFGAS revised the "E-factor" criteria, and rejected most of the schemes submitted for approval. Expected reductions of CO₂ emissions deriving from activities of the EST were consequently revised downwards and were estimated to be about 110 Gg of CO₂ or 0.3 Mt C. The Government decided to provide core and programme costs from 1996 until the gas and electricity sectors are fully liberalized. Up to £50 million is expected to be made available in the three-year period starting 1 April 1996. The team found the Energy Saving Trust to be an innovative and potentially significant vehicle for emissions reduction.

40. The Government is committed to providing incentives and support for the utilization of new and renewable energy sources, including a supporting programme of assessment and market enablement. Commercially competitive technologies capable of penetrating the market are given special attention. One of the elements of the climate change programme is to work towards 1,500 declared net capacity of new electricity generating capacity from renewable sources for the United Kingdom by 2000. Achieving this increased capacity by 2000 will annually save about 2 Mt C (as carbon dioxide), plus 100,000 tonnes of sulphur oxides (SO_x) and 30,000 tonnes of NO_x. Total electricity generation from renewables in 1994 amounted to 7,293 GWh mainly from large-scale hydro generation. Renewables provided about 2 per cent of the electricity generation in the United Kingdom. There is practically no potential for further development of large hydro stations.

41. To facilitate the penetration of renewables and enhance their commercial competitiveness the Government introduced the non-fossil fuel obligation (NFFO) in England and Wales, the Scottish renewables obligation in Scotland and NI-NFFO in Northern Ireland. Under the NFFO, public electricity suppliers are required to contract for specified amounts of electricity generated from non-fossil fuel sources at a premium market prices. The suppliers are then reimbursed for these additional costs by a 10 per cent levy on all retail electricity sales. For the nuclear industry this subsidy is to be discontinued in 1998 but it is still to be applied for renewable sources of energy. As a result of the first and second NFFO orders, more than 340 MW of renewables-based capacity were developed. The third order (December 1994) covers the period from April 1995 to March 2014 and should induce the creation of an initial market for renewable technologies; this order was concluded for 627 MW. The premium price paid to renewable energy generators is financed by the fossil fuel levy paid by licensed electricity suppliers and reflected in electricity bills. The size of the levy is set by the Director-General for Electricity Supply. Under the levy some £96 million was paid in 1994/95 for renewables. The amounts raised by the levy are expected to peak at about £150 million a year over the period 1997 to 2000.

42. One of the main policy directions in reducing CO₂ emissions is the improvement of the energy efficiency. Primary responsibility for the energy efficiency policy lies with the

Department of the Environment, and in particular with its Environmental and Energy Management Directorate (EEMD). Its major task is promoting and implementing a range of policies related to environmental management and energy efficiency issues across all major sectors, on both the supply and demand side.

43. The residential sector accounts for about 28 per cent of total CO₂ emissions in the United Kingdom. It is acknowledged that there is a significant economic potential for energy savings in this sector and the Government has a range of fiscal, regulatory and educational measures aimed at exploiting this potential. The Home Energy Efficiency Scheme provides grants to low-income households to encourage basic energy conservation measures; it has a budget of about £73 million covering 600,000 homes for the 1995/96 financial year. House renovation grants, administered by local authorities, provide help for heating and insulation works for the same category of households. In 1994, almost 100,000 house renovation and disabled facilities grants were approved at a cost of almost £478 million. Although these measures are mainly motivated by social considerations, they are also relevant in the climate change context because they reduce the potential for increased emissions as heating standards improve.

44. In July 1995, revised building regulations were introduced in the United Kingdom. These raise the minimum standard of energy performance expected from new residential, commercial and industrial buildings, as well as from existing buildings during renovation. Although the building stock is extended or replaced at low rates (about 1 per cent per year) and thus the upgrading contributes little to overall annual energy savings, the Government believes that in the longer term improved standards will have a significant effect on CO₂ emissions. It is estimated that, thanks to the 25 to 35 per cent saving in energy used for space heating and hot water supply in the houses benefiting from these schemes, about 900 Gg of CO₂ or 0.25 Mt C per year could be saved nation-wide by the year 2000 and even more thereafter.

45. Local authorities are seen as having an important role to play in improving energy efficiency in the residential sector. Under the Home Energy Conservation Act, adopted in 1995, local authorities are required to consider and report on energy conservation measures designed to increase energy efficiency by 30 per cent across private and social housing in their areas. The report must include an assessment of the likely decrease in CO₂ emissions as a result of those measures. The Act requires the Government to set timetables for the implementation of measures and provides for local authorities to produce their first reports in 1996.

46. Among the measures coordinated with other EC countries and already in place in the United Kingdom, the team noted energy labelling directives covering domestic refrigerators and freezers (regulations requiring all domestic washing machines and tumble-dryers to carry energy labels apply since April 1996), eco-labelling schemes aimed at identifying environmentally benign products, and a minimum energy efficiency standards directive

covering new central heating boilers. A draft directive covering refrigerators and freezers being discussed at present could result in 1,800 Gg of CO₂ or 0.5 Mt C annual savings in the United Kingdom in the first phase, when existing appliances have been replaced by new, efficient ones. Common energy/CO₂ taxation has been discussed as a main pillar in the EC strategy to limit CO₂ emissions. The Government has decided that it does not need a CO₂ tax to attain its national target and to fulfill its commitments under the Convention, and that it does not intend to support the introduction of the proposed European Community CO₂/energy tax.

47. Efforts to encourage improvements in energy efficiency in the business community centre around two programmes: the Making of a Corporate Commitment campaign (MACC) which aims to stimulate top management interest in energy management and the Energy Efficiency Best Practice programme, a £15 million a year information and technology transfer programme. Under MACC, some 2000 business organizations have signed a declaration of commitment - a voluntary obligation to work towards the efficient use of energy and they have taken advantage of the services provided by the Best Practice programme. The Best Practice programme, which covers all sectors of the economy, seeks to advance and spread good practice in energy efficiency relating to both established and innovative technologies, and their applications. Current estimates are that between them both MACC and Best Practice will stimulate savings of 5Mt C by 2000; by the end of 1994, the programmes had already generated annual reductions of nearly 2Mt C.

48 Transport is a sector where, according to inventory data for 1990-1994, GHG emissions were continuing to rise and are projected to grow in the foreseeable future. In December 1994, the Government launched a nation-wide discussion on the future of transport, with the aim of developing possible policy actions in this field. The Government is committed to increasing motor fuel duties each year by at least 5 per cent a year on average above the rate of inflation. In fact real increases in duties have been greater than that, the average increase in duty being around 6.7 per cent per annum for unleaded petrol, 7.7 per cent for leaded petrol and 8.4 per cent for diesel fuel for the years from 1992 to 1995. In addition to giving incentives to drive less, this measure was intended to provide an incentive to purchase more fuel-efficient cars. According to the IEA in the period from 1990 to 1995 the price (including taxes) of premium unleaded fuel (95 RON) in the United Kingdom increased by about 22 per cent and that of diesel fuel by about 23 per cent. It is estimated that this measure will contribute about 11,000 Gg of CO₂ or 3.0 Mt C per year in savings by the year 2000, an increase of about 1,800 Gg of CO₂ or 0.5 Mt C per year compared to earlier estimates. Another measure that is expected to help reduce GHG emissions is the liberalization of the public transport system, which has already taken place. The Government believes that it will lead to more efficient services and may increase the share of public transport in the longer term. Development of a better public transport system, like parking restrictions and congestion charging, is not primarily a GHG reduction measure, but may result in a small but significant benefit. The team noted that plans to use alternative

fuels, such as liquefied petroleum gas (LPG) and compressed natural gas (CNG), are at present at a preliminary stage. Potential results of these measures were not available.

50. Voluntary partnerships are another policy direction pursued in efforts to limit GHG emissions in the transport sector. The Greener Motoring Forum is an example of such partnerships aimed at encouraging environmentally responsible motoring by making recommendations to Government, motor manufacturers and others. The recommendations to date include launching a campaign to encourage motorists to reduce the environmental impact of their cars by proper tuning and maintenance, and introducing an environmental information scheme for new cars enabling prospective buyers to assess their performance in terms of emissions, fuel efficiency, etc.

51. An important element of the United Kingdom climate change policy is the enhancement of sinks. As there is a separate target of maintaining removals at a stable level at least equal to that of 1990, measures aimed at protecting existing forests and expanding tree cover are given specific attention. The United Kingdom is encouraging afforestation through incentive schemes such as the Woodland Grant Scheme and the Farm Woodland Premium Scheme (FWPS). In 1995, the annual rate of planting under the FWPS was nearly 7,000 hectares. Overall the afforestation/reforestation programme has led to approximately 34,000 hectares of forest being planted each year in England and Wales. Approximately half of this is considered "new" forest while the other half is restocking of existing forest areas. There is some urban tree planting but there is no programme that receives central government funding. The amount of carbon annually sequestered by forests is estimated to be about 8,700 Gg of CO₂ or 2.4 Mt C and it is expected that this rate will prevail until 2000.

52. The main sources of **methane** (CH₄) in the United Kingdom are landfill waste, agriculture and coal mining. Together they accounted for about 86 per cent of total methane emissions in 1990. Agricultural emissions mainly follow developments in livestock, and no specific measures to reduce methane emissions are seen as feasible or introduced at present. As various issues related to the future of agriculture are being discussed in the European Community (i.e. reform of the common agricultural policy), the only work in this area is in mitigation option assessment and applied research. Landfills are the biggest single source of methane and without implementation of mitigation measures, emissions would have increased by 25 per cent over 1990 levels by 2000. With anticipated measures, emissions are expected to fall by nearly 10 per cent by 2000.

53. As part of a new waste strategy, the Government has introduced a landfill tax levied on the landfill operators, which has been in force since 1 October 1996. The tax will be weight-based and set at a standard rate of £7 per tonne, with a lower rate of £2 per tonne for inactive waste. The Government also intends establishing a trust, supported by voluntary contributions from landfill operators, 90 per cent of which would be refunded by the Government in the form of reduced tax collection. Allied to the landfill tax is a credit

scheme. Landfill operators who contribute to environmental trusts for approved purposes can claim a tax credit of 90 per cent of their contribution, up to a maximum of 20 per cent of their annual tax liability. The trust funds would assist with problem-solving in waste management, e.g. clean-up of contaminated sites and research into sustainable waste management alternatives. Under the current waste management system, landfill operators are usually required to collect landfill gas and where economically viable use the gas for power generation. Operators seeking new licences or the renewal of existing licences would have to conform to this requirement or risk being denied a licence. The Government expects that, as a result of all measures related to landfill emissions reductions, about 80 per cent of landfill gas will ultimately be collected and used at about 80 per cent of the sites. In 1993 about 21 per cent of CH₄ emissions from landfills were collected.

54. Natural gas distribution and storage is estimated to release an amount of CH₄ equivalent to 1 per cent of total throughput. Industry has voluntarily offered to achieve a 2 per cent per year reduction in this leakage rate as part of maintenance activities, e.g. through replacement of pipelines. It has also set a target of reducing CH₄ leakage from storage facilities by 15 per cent from 1992 to the year 2000, a reduction of about 3 per cent per year.

55. Many industrial sources of CH₄ are subject to BATNEEC³ and regulations are enforced by the Inspectorate of Pollution (Environment Agency from April 1996). As limits on emissions of pollutants become more and more stringent, CH₄ emissions from these sources tend to decrease. Although enforcement of BATNEEC requirements is mainly done for other purposes, it does contribute to a reduction of some GHG emissions. For a number of smaller sources of methane, the Government has used a consultative approach with industry in order to achieve real emission reductions. First, the Government commissions a research study, based on agreed terms of reference, on the nature of the source and least-cost mitigation options. Next, industry agrees to formulate guidance for managing emissions (including audit, measures to reduce emissions and the development of inventory approaches). Finally, industry is expected to follow its own guidance, where cost-effective and practical, performance being monitored by the Department of the Environment. This approach is currently used for methane emissions from sewage treatment and disposal (expected to increase to 2000 without measures), offshore oil and gas methane (expected to increase to 2000 without further measures), and coal-mine methane emissions (expected to decline by 2000).

³ BATNEEC stands for "best available techniques not entailing excessive costs" and is part of the United Kingdom's integrated pollution prevention regime. On a four-year rolling programme, emission limits are set for individual sources of pollution based on BATNEEC. Industry must then conform with these limits or justify why it cannot do so to the Inspectorate of Pollution. Fines may be levied for breaches of authorisation conditions.

56. Over the last four years, N_2O emissions have been declining owing to a fall in adipic acid production, which is the main source of these emissions. The industrial emissions will diminish by more than 90 per cent with the implementation of process changes to meet BATNEEC requirements expected by the year 2000. Emissions of N_2O from agriculture were estimated, using the IPCC methodology, to be small compared to those from industry and falling steadily. The uncertainties are large, but research is under way on these emissions.

57. Emissions of CO , $NMVOG$ and NO_x are on the decline as a result of measures implemented over a number of years to comply with the Convention on Long-range Transboundary Air Pollution and its protocols. The European Union has also issued a number of important directives aimed at reducing these emissions, notably NO_x , for example by imposing the use of catalytic converters on all new vehicles.

58. While small in absolute terms, HFC production and use in the United Kingdom is estimated to be growing rapidly, as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) are phased out. The Government is currently concluding voluntary agreements with all the major user industries to ensure that long-term emission reductions are achieved. Nevertheless, emissions are expected to rise from 1,000 tonnes in 1990 to 13,000 tonnes in 2000. PFC emissions from primary aluminium smelting fall under the Environmental Protection Act of 1990 and their release is regulated by the Inspectorate of Pollution. Estimates for the future assume that the application of abatement technology will reduce these emissions to 10 per cent of their 1990 level by the year 2000. The United Kingdom has strengthened local air pollution control guidance to ensure that consumption of SF_6 by magnesium foundries is minimized. Work is in hand to establish emission inventories for $HFCs$, $PFCs$, and SF_6 .

IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

59. The United Kingdom has a well developed projections methodology for estimating future trends in GHG emissions. The team was presented with comprehensive and transparent information documenting both the approaches used and the results of predictions made using updated basic parameters.

60. New projections for **energy-related CO_2** emissions were published in *Energy Paper 65* produced by the Department of Trade and Industry in March 1995. These projections differ from those presented in the original communication (which was based on the paper published in 1990) in several important respects, namely:

(a) They reflect the effects of the recently introduced government policies on energy and the environment (i.e. the decision not to further raise VAT to 17.5 from 8 per cent on domestic energy and to impose a 5 per cent average real increase in motor fuel duties each year);

(b) They have a more disaggregated approach (eight industrial subsectors are considered instead of the two used in the earlier paper);

(c) They take account of the lower-than-expected growth in gross domestic product (GDP), the significant increase in the use of gas in the electricity supply industry, the higher-than-expected contribution of nuclear power to electricity generation, the shifting of the fuel mix away from coal, the higher-than-expected rate of commissioning of new combined cycle gas turbine stations, and lower-than-expected fossil fuel prices.

61. The Department of Trade and Industry's econometric model used a number of regression equations linked to a model of the electricity supply industry to generate six different scenarios of economic growth (low and high energy prices, and low, medium and high GDP growth), and consequently fuel demand and CO₂ emissions for the period up to 2020. The model makes certain assumptions related to possible changes in the development of the United Kingdom's economy, such as an increasing role for the services sector, growth of the energy sector up to the year 2000 and its decline thereafter (with the expected reduction of oil and gas production) and an unchanged share of the agricultural sector in GDP.

62. Both "with measures" and "without measures" projections have been made using the model. The results of modelling indicate that, based on central assumptions, projected CO₂ emissions in 2000 would not exceed their 1990 level even without the additional measures listed in the climate change programme. With implementation of the policies and measures provided for in the programme, average additional savings of 7.5 Mt C per year would be achieved by the year 2000 (leading to projected emissions of 6 to 13 Mt C per year below the 1990 level for high and low growth scenarios respectively).

63. The Department of Trade and Industry's model also gives projections for specific sectors of the economy for the year 2000 and beyond. For the year 2000 the projections indicate that: in the electricity supply industry, for both high and low-prices scenarios CO₂ emissions decline sharply; transport and refinery emissions rise steadily in all scenarios; emissions from the domestic sector fall gradually after an initial rise between 1990 and 1995; services sector emissions increase but moderately; emissions from other sectors rise or fall to some extent depending upon the scenario.

64. In the period between 2000 and 2020 every scenario projects an increase in CO₂ emissions - rising significantly from 2000 to 2005, then almost levelling off and sharply rising again between 2010 and 2020. This trend reflects the fact that reserves of natural gas may diminish, demand for energy is expected to increase and on current estimates the majority of nuclear power stations could reach the end of their life in the first decade of the next century. It is difficult to predict at present what the effect of coal industry privatization will be on coal prices and consequently on coal's attractiveness as a fuel, or what will be the future of the nuclear industry, which is being privatized.

65. The team noted that, although a range of scenarios were presented in the projections, the independent reviews of the assumptions made were not available. In some cases, in particular for the transport sector where emissions are expected to rise significantly, it was not clear whether other government programmes, such as the construction of new roads and urban development, were incorporated into the projections scenarios. The team was not able to verify the estimated effects of all individual measures on the basis of the information made available to it.

66. It is also worth noting that the most important variables in the projections are GDP projections and fossil fuel prices, whereas in practice CO₂ emissions will depend on a number of other factors which no model can take into account. Some model assumptions, especially related to the electricity supply industry, are highly uncertain. However emerging general emission patterns seem to indicate that additional measures might be required after the year 2000 to reverse the upward trend in projected CO₂ emissions. The Government acknowledges this situation although in the *Nuclear Review 1995*, the Government concluded that "there is at present no evidence to support the view that new nuclear build is needed in the near future on emissions abatement grounds". In the longer term, "if a need arose to make further substantial reductions in gaseous emissions, there could be a role for new nuclear capacity beyond 2010".

67. For **non-CO₂ greenhouse gases** the United Kingdom uses an engineering approach which is based on the expected levels of activity underlying the emission trends. Where relevant, for example in the transport sector, the assumptions used are consistent with those presented in *Energy Paper 65*. In the process of projecting emissions of CH₄ and N₂O, the Department of the Environment consults organizations in the sectors responsible for producing the emissions as well as other government departments and the National Environmental Technology Centre, which is the technical body responsible for keeping the emissions inventory. These projections up to the year 2000 aim to include all the measures that have been adopted.

68. In general, the projections indicate that emissions of non-CO₂ gases will continue to decline (as was the case between 1990 and 1995); for example, the team was informed that overall CH₄ emissions are expected to fall by 0.7 Mt by the year 2000 (0.1 Mt more than estimated in the initial communication), or about 16 per cent between 1990 and 2000, mainly as a result of landfill policies and reduced levels of agricultural activity. Nitrous oxide emissions are projected to decline from around 110 kt in 1990 to 30 kt in 2000, while emissions of HFCs and PFCs are also projected to fall off significantly. The precursor emissions are projected to decrease as a result of measures taken to comply with the United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution.

69. The Department of Trade and Industry model is also used for monitoring the effects of fiscal measures. Both the original communication and supplementary information made available to the review team provide specific estimates of the effects of groups of measures.

The United Kingdom is currently considering developing the procedures for monitoring the effects of individual CO₂ abatement measures. They will depend on the type of measures and will, for example, include econometric models for fiscal measures, feedback from industry for voluntary agreements, evaluation of the results of introducing new standards, and national statistical data for CHP and renewable energy sources.

V. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES

70. As the national communication was published before the INC guidelines were adopted, it does not contain a specific section on the expected impacts of climate change. During the visit the team was presented with extensive information on this subject, including a report published by the Department of the Environment in 1991 entitled, "The potential effects of climate change in the United Kingdom". The report discusses in detail such subjects as future changes in climate and their impact on sea level, soils, flora, and fauna, landscape, agriculture and forestry, coastal regions, energy, minerals extraction, transport, recreation and tourism. The report concludes that changes in climate could have significant impacts in some sectors and in some regions of the United Kingdom, both of a beneficial and of an adverse nature. It recommends that research in this area be continued with the aim of identifying possible adaptation measures in potentially vulnerable sectors and areas. The team was informed that this work is under way, and the results were to be published in 1996.

71. The United Kingdom has established the Climate Impacts LINK Project providing climate change scenarios for impact assessment in the country and serving as an organized and open interface between modellers of the physical climate system and those of physical and social systems which are sensitive to climate change. A progress report on the LINK project was published in 1994. As separate activities, technical guidelines on impact assessment were developed in collaboration with Japan and adopted by the IPCC; an independent expert group published a report studying, *inter alia*, water supply sensitivity, the possibility of increased frequency of storm events, the effects of reduced soil moisture content on agricultural productivity and stability of built structures. Newsletters outlining the latest climate change scenarios are circulated widely.

72. The United Kingdom experienced a remarkable climatological episode from autumn 1988 to autumn 1990. During that period there were two successive mild winters and hot summers, and extended drought conditions in much of eastern and central England. The relevant climatic data and impacts on the terrestrial environment, freshwater systems, agriculture and horticulture have been studied extensively, as this episode could be seen as an example of the weather pattern that may occur more frequently as a result of climate change.

73. The United Kingdom has not implemented specific adaptation measures so far although some policies such as the appraisal of all new or improved coastal defence works already take account of estimated future trends in relative sea level. Wider response strategies will be investigated as part of a future integrated impact assessment with the participation of interested parties such as the insurance industry.

VI. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

74. This item was adequately dealt with in the original communication, and the team was provided with some additional information on the subject. The United Kingdom contributed fully to the Global Environment Facility, both at the pilot stage and for the replenishment. The United Kingdom has committed a total of £130 million to the Facility, and is the fifth largest donor. Official development assistance represented 0.28 per cent of GNP in 1995 and has been relatively stable over the recent years.

75. The Overseas Development Administration - the government department in charge of foreign aid - has specific strategies for the environmental assistance, including climate change-related activities. They include, *inter alia*, funding of research on methane emissions from rice cultivation, and the potential impacts of climate change on coral reefs and tropical crops. In the framework of the energy efficiency strategy, the Administration spent over £267 million on corresponding projects between 1991 and 1995 and also focused its efforts on promotion of renewable energy sources.

76. Transfer of technology and know-how is a central element in most aid projects. In addition, the United Kingdom particularly acknowledges the role of the private sector in technology transfer. A "technology partnership initiative" coordinated by the Department of Trade and Industry was therefore launched in 1993. The role of the Government is seen as that of a facilitator in providing the developing countries with information on British technology and companies that possess it. The team was informed that the initiative is being constantly monitored but by the time of the visit it had not been operative long enough for a meaningful evaluation of its effects to be made. The initiative has now been extended for a further three years. The team considered this initiative to be an innovative and potentially replicable measure.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

77. The team was impressed with the scope and quality of both national and international climate change research in the United Kingdom. In addition to the research on inventories methodology, renewable energy sources, emissions mitigation and impact assessment briefly

mentioned in previous chapters, a comprehensive climate research programme is under way. This programme was adequately described in the original communication but some important additional information was communicated to the team.

78. The Hadley Centre for Climate Prediction and Research completed the first regarded to be credible simulation of the observed rise in global temperature over the past 100 years, which constitutes a significant contribution to the understanding of global climate processes. The United Kingdom also provided technical support units that facilitated preparation of the IPCC Report on Radiative Forcing and the IPCC Guidelines for National Greenhouse Gas Inventories. The United Kingdom finances the activities of the technical support unit of Working Group I of the IPCC, which is responsible for the science of climate change.

79. A number of important research projects are under way in various ministries, which facilitate coordination of climate-related research and development with the scientific community and the private sector. The team was informed that, according to recent estimates, the United Kingdom had spent about £200 million on climate change research in 1993/94.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

80. With its emphasis on voluntary actions, it is natural that the United Kingdom attaches great importance to activities in the field of education, training and public awareness. Some £130 million has been spent on energy and fuel efficiency awareness and advice programmes since 1990. Targeted groups included specific sectors of the economy, consumers, non-governmental organizations, and households. The team noted that dissemination of information was primarily aimed at promoting energy-saving options and other environmental issues such as recycling refuse or saving water. The Government, through the Department of the Environment and the Environment and Energy Management Directorate, coordinates this process by organizing conferences, exhibitions and campaigns, publishing a climate change newsletter, etc.

81. The Directorate's Best Practice Programme is the Government's main programme for dissemination of information on cost-effective energy efficiency measures. Under the Programme, the Directorate produces a range of publications providing independent, authoritative guidance on energy efficiency. The team was informed of various initiatives to raise awareness of the link between the threat of global warming and energy use in households and small businesses. Two campaigns were mentioned in this respect: *Helping the Earth Begins at Home* and *Wasting Energy Costs the Earth*. They aim at improving energy efficiency by promoting energy-saving light bulbs, loft insulation and heating controls.

82. The Government recognizes the need for a body to coordinate and promote the teaching of energy efficiency in schools. It considers that the Centre for Research, Education and Training in Energy (CREATE) is best placed to carry out this role and has increased support for its activities. The Energy Saving Trust is also regarded as a means for providing advice on energy efficiency to the public at large and to small businesses through its network of local energy advice centres.

83. Environmental groups are active and influential in the United Kingdom. Many of them provide public information on the greenhouse effect and the environmental consequences of energy use. Industry plays an important role in concluding and implementing voluntary agreements, which constitute an essential part of the United Kingdom's climate change policy, and the involvement and activities of industry are also seen as increasing public awareness.
